Future of the Delta: Measuring Biodiversity and Energetic Reliance in Key North Delta Habitats

#0039

Technical Panel Review

Proposal Name: Future of the Delta: Measuring Biodiversity and Energetic Reliance in Key North Delta Habitats

Applicant Organization: The Regents of the University of California

Principal Lead Investigator(s):
Engilis, Jr., Andrew
Peter, Moyle
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Amount Requested: $666,105

TSP Panel Summary of Findings:

This is an ambitious proposal. The investigators propose to study three important regions within the North Delta, with multiple sites to be studied within each region. Furthermore there are three distinct components comprising the project: study of fish, study of birds, and elucidating food web connections with stable isotopes and PUFA. The focal areas are important regions of the Delta for further study, especially Cache Slough of which little is known (its "ecological refuge" value is probably high and thus worth investigating). The questions they set out to address provide us with a very good beginning, but unfortunately the proposal itself by and large does not spell out how to answer the questions. For instance, they pose the question, Which aquatic and terrestrial species can serve as indicators of success of management and restoration actions for North Delta habitats? But they do not explain how they will answer this question. Another example is their question, What management actions for fish can benefit birds, and vice versa? Again, they do not outline how this question will be answered. The conceptual model presented is inadequate. The proposal seeks to address the question of whether the Cache Slough region has the potential to be an ecological refuge, but they do not make clear how they will evaluate its ability to serve as a refuge and the general ecological significance of trying to answer that question. Can this information then be used to identify other potential

refuges? And what role do refuges play ecologically? A site can be an ecological trap, while appearing to be a refuge. Futhermore, their understanding of the Cache Slough system seems slight and at least some of the field methods won't work, such as 70m radius terrestrial vegetation plots where there is a very narrow band of emergent marsh before encountering a levee. The three sections of the proposal are uneven. Regarding the food web analyses, methods are clearly described but not so for the bird section. They do not make clear what parameters will be estimated, nor do they describe how such analysis will be accomplished. In general, the investigators do not describe how they will design their study and analyze their data with respect to variation within sites (marshes), among sites but within a region, and among regions. They do not describe how exactly they will build on earlier and current data collection. The foodweb analyses present the most novel aspect to the study and have a high potential to provide extremely useful information for CALFED and managers in general. The fish component will undoubtedly provide some useful data, but the panel would prefer to see more information that could elucidate ecological processes (growth, reproduction, prey, predators) that influence fish populations. The bird component is only vaguely described. Nor do the investigators describe how bird and vegetation information will be integrated. There was no task to compile the results from each task into a useable synthesis. In summary, this study could be relevant with respect to CALFED objectives and because of its collaborative, multi−disciplinary nature has good potential, but the proposal does not adequately describe how this potential will be realized. The key to making this study useful to CALFED is to integrate the breadth of information into a valuable understanding that can inform restoration planning in the short and long term. The panel recommended that, perhaps if the project proponents took more time to develop the proposal thoroughly and rigorously, it could be revised into a project that is worthy of funding.

Relevance to PSP Topic Areas:

Moderate

TSP Technical Rating:
Sufficient

TSP Funding Recommendation:
Do Not Fund

TSP Amount Recommended: $**0**

Conditions:

External Technical Review #1

Proposal Title: Future of the Delta: Measuring Biodiversity and Energetic Reliance in Key North Delta Habitats

Proposal Number: 0039

Proposal Applicant: The Regents of the University of California

Purpose

Comments	**Questions to be answered by this proposal include: 1. Do the freshwater tidal areas of the North Delta, especially the Cache Slough region, have the potential to become ecological refuges for the biota of the Delta (and Suisun Marsh)? a. What areas have the highest potential for ecosystem enhancement? 2. Which aquatic and terrestrial species can serve as indicators of success of management and restoration actions for North Delta habitats? a. How do these incorporate and relate to MSCS species? b. What are the distributions and habitat requirements for these species? c. Do results from demographic and energetic analyses support results obtained through population level analyses? 3. Can restoration actions benefit linked ecosystems? a. What management actions for fish can benefit birds, and vice versa? b. What are the energetic reliances between aquatic and terrestrial systems? c. How diverse are these relationships and what are the strengths of their linkages? d. What restoration actions are most likely to improve conditions for native and endemic species in Cache Slough and other Delta habitats? The objectives as addressed by the questions above are clearly stated,timely and important and will add to the base of knowlwedge.**
Rating	

	Sufficient

Background

Comments	**There was no clear conceptual model for the proposal. In short the proposal will conduct fish and bird inventories mainly on a single marsh and conduct isotope studies on key aquatic and bird species to establish energetic relationships between terrestrial; and adjacent aquatic habitats. Although much proposal space talks about restoration, disturbance, refuge and management, little attention is given to the details of those subjects. For example, no management actions for fish that would benefit birds were proposed. Nor were restoration plans proposed. I believe those plans will come as a better understanding of the study area proceeds, but they are presently not a part of the proposal.** **For questions 1–3 the investigators state will be answered by this proposal, there are no abiotic/biotic/policy/economic criteria provided by which to determine a suoitable ecological refuge, areas of highest potential for ecosystem enhancement, species to indicate management or restoration success and actions that benefit linked ecosystems. Such criteria should be given careful consideration and explanation. Perhaps careful use and explanation of what the investigators mean by the term "restoration" i.e. what needs restored – species, hydrology, habitat, flows, productivity?**
Rating	**Inadequate**

Approach

Comments	**The proposal indicates 3 study areas, of which 2 are already being studied under grants for other projects. Thus, it was not clear the purpose for adding a 3rd area? for study? In terms of background, there was no**

clear comparison of the study areas in terms of degree of disturbance, biodiversity, hydrology, abiotic/biotic gradients or other meaningful ecological similarities or differences by which habitat template comparisons affecting structure function can made. It would be helpful if this information were put together as a table comparing the key physiognomic topographical, hydrological, area, tidal etc. characteristics of the 3 areas. One way to look at this is as a natural trajectory experiment, with careful consideration of experimental and treatment design. Disturbance appears to be a major driver for proposed changes in biodiversity and energy flow, yet there was a general lack of literature on disturbance and effects on biodiversity and energy flow. For example, the intermediate disturbance hypothesis predicts disturbance relative to habitat stability. Do the 3 study areas vary along such a disturbance gradient? If so, apriori hypotheses can be generated realtive to fish/bird diveristy. With regards to disturbance, the table could show types, degree and spatial and temporal magnitude of disturbances.

For the proposed vegetation surveys to be collected once at each study area. I am not convinced a one−time sample adequately characterizes the vegetation community in terms of species composition and only % cover measures will be taken. This limited sampling strikes me as insufficient since elsewhere the investigators discuss “productivity and energy flow, and yet no independent measures of this important variable will be collected. For example standing crop biomass seems a critical element differentiating different habitats in terms of quality not only to

	avian fauna but also indirectly to aquatic fauna as an energy subsidy to wetlands and mudflats associated with tidal flow over marshes and along riparian zones. **Subtask 6b. Analyze higher order species for stable isotopes. "We will test differences in the cross−habitat energetic linkages among sites using multi−way analysis of variance (ANOVA) with proportion of cross−habitat subsidy using isotopes as an index) as the independent variable, and site, season, and year as factors." Isotopes represent the dependent variable.** **Subtask 6c. PUFA analysis of habitat−specific taxa To detrmine the proportion of energy derived from varying habitats proposed are at least 10 replicates of a representative producer, and primary and secondary consumer will be collected. It is unclear here the spatial and temporal dimensions over which the replicate samples will be collected/ It would be interesting and ecologically meaningful to consider season, year, study area, marsh type, habitat within a marsh etc. This needs to be clarified.** **The management tasks and administration of the project are clearly stated and the investigators have an excellent plan and track record for widespread and effective dissemination of information.**
Rating	**Sufficient**

Feasibility

Comments	**My assessment is that the investigators are at the early stages of an ecological study on a relatively unstudied ecosystem and are setting the stage for more integrative studies to be**

	conducted at a later stage, once a better understanding of the structural elements of the 3 major study areas have been determined. This is also reflected in the lack of hypothesis testing and experiments in the proposal designed to explain patterns of diversity and food web structure in different marshes. There is also a lack of detail addressing the disturbances frequently mentioned as agents of change and concern for biodiversity. The disturbances, temporal and spatial scale and magnitude, need greater consideration, explanation and measurement in order to make sense of the predicted changes in marsh structure and function. The partnerships explained in the proposal are a strength and important to project success.
Rating	Above Average

Budget

Comments	The budget appears reasonable and adequate for the work proposed.
Rating	Sufficient

Relevance To CALFED

Comments	The investigators make a good case for the relevancy of their biodiversity and food web studies to CALFED PSP priorities and others, and the information will be of use to resource managers.
Rating	Above Average

Qualifications

Comments	The investigators have a good track record and appear qualified to conduct the proposed research. Several ongoing funded projects show some experience with the study areas. One concern is the isotope lab is just

	getting underway, so there may be start up concerns until it is up and running. Another is the Pelagic Organism Decline appears to be a cause for altering energy pathways in trophic levels, yet there are no phytoplankton/zooplankton studies described and little plankton expertise among investigators.
Rating	**Above Average**

Overall Evaluation Summary Rating

Comments	**This proposal has great promise with better explanation, description and monitoring/manipulation of disturbances, a better understanding of community structure provided by currently funded projects, a more hypothesis driven and comparative approach (among marshes and between riparian/aquatic/marsh). Because of other funded projects already underway, the purpose of this proposal appears to have significant overlap, with the exception of an additional marsh and the isotope studies. This proposal might be better developed if data and results of the studies underway were analyzed.**
Rating	**Sufficient**

External Technical Review #2

Proposal Title: Future of the Delta: Measuring Biodiversity and Energetic Reliance in Key North Delta Habitats

Proposal Number: 0039

Proposal Applicant: The Regents of the University of California

Purpose

Comments	**This appropriately ambitious project will provide a wealth of important information regarding ecological elements and processes several key Bay Delta aquatic ecosystems and their associated riparian areas. The proposal is very well written and organized, with clearly stated questions and objectives. The six program phases are clearly linked and follow a necessary and logical progression. The project will greatly advance ecological understanding of the ecology of Cache Slough, the most intact and least studied aquatic system in the North Delta, and will also reveal the relative roles of several aquatic systems (Cache Slough–Liberty Island, Yolo Bypass–Putah Creek, Cosumnes River) in supporting avian and fish communities in the region. There is no doubt that the synthesis of data collected through this study will be of great value in guiding the management and restoration of these precious and threatened ecosystems. The proposal clearly justifies the need for the data to be collected, but also builds on existing datasets. The questions posed are very general in nature: 1) potential for Cache Slough to be ecological refuge, 2) which fish and birds serve as ecological performance indicators, 3) can restoration benefit both aquatic and terrestrial habitats through trophic linkages. More specific hypotheses could have been suggested for each. While all of the data to be collected will be invaluable, the data collected to investigate question 3 will generate novel information**

	about energetic reliances within the aquatic–terrestrial ecotone is likely to greatly expand conceptual understanding of Bay Delta restoration processes.
Rating	Superior

Background

Comments	The key concept of energetic reliance could have been made a more powerful conceptual centerpiece of the proposal. However, the figure depicting food web connections across the aquatic–terrestrial ecotone was valuable. It seems there is room for proposing hypothetical feedback loops as part of this concept. That being said, the proposal provides an ample literature review to support the importance and value of the proposed work. The conceptual process model provided, albeit very well designed and helpful, is more a flow chart describing project activities than a framework of underlying ideas.
Rating	Above Average

Approach

Comments	The project involves a large team, with impressive prior experience within the project study area. There are 6 avian ecologists and 2 fish ecologists, and a sub–contractor specializing in isotope food web analysis. It may be that the avian component of the project is more difficult and time consuming, and therefore requires more staff resources. I do think it important that the terrestrial and aquatic data to be collected in this project be of equal weight and quality in order to provide an adequate picture of aquatic–terrestrial energetic reliance. The study builds nicely upon previous baseline studies and restoration projects in the study area. The data will be integrated into several existing databases. The

	study design, including fish sampling, bird counting and netting, and habitat mapping, are based on standard techniques already used in previous studies of these systems. The analysis of food webs and terrestrial–aquatic ecological reliances will use a complete suite of stable isotopes – C, N and S, as well as analysis of polyunsaturated fatty acids to trace lipids from primary producers to consumers. This approach will maximize the separation of energy source signatures for the fish and bird consumers to be analyzed.
Rating	**Superior**

Feasibility

Comments	**This is a project of significant scope, but the project team is endowed with a wealth of experience from previous projects of similar scope. The sample sizes and sampling design are appropriate to provide representative values, and power analysis has been used to determine sample sizes for bird habitat use and demography. Data collection across seasons is an easily overlooked strength of this proposal. I do raise a question about the complications that may arise in the isotope and PUFA analysis of tissue samples of migratory versus resident species of birds and fish. Samples should be taken long enough after the arrival of a particular migrant species such that its tissues adequately reflect the energy sources of its current surroundings. It would be instructive to compare energy signatures between migrant and resident species groups. It would also be instructive to compare energy signatures of native fishes (2 focal species in study) and non–native fishes (4 focal species in study).**
Rating	**Superior**

Budget

Comments	**The breakdown of the budget provides excellent detail, and the budget justification is clear and thorough. The two senior PI's will not receive salary from the project. Funds will be well used to support a post-doctoral researcher for overall project coordination as well as synthesis of species-habitat relationships. Support for technicians, supplies, lab analyses and overhead all seem very reasonable. Two additional grants and funds from UC Davis for an isotope lab set-up total about $145,000.**
Rating	**Superior**

Relevance To CALFED

Comments	**This proposal thoroughly addresses PSP topics 3) Trends and Patterns of Populations and System Response to a Changing Environment, and 4) Habitat Availability and Response to Change for several important aquatic-terrestrial ecotones in the North Delta. In addition, the project will build upon and contribute significantly to several existing databases. The food web focus will allow an extremely important conceptual synthesis of the large amount of habitat, bird and fish distribution and abundance data that will be amassed. An added plus for this project are the many existing ties to management and policy among the project PIs and staff, and the significant outreach and collaboration with conservation and management groups that is outlined, as well as a project website. The project team represents a strong collaboration of terrestrial, aquatic, and a food web ecologists, who will develop food web and habitat models. A related proposal is pending with Calfed that will use this project's aquatic habitat data to model climate change impacts to fish population ecology.**
Rating	**Superior**

Qualifications

Comments	**The project team is extremely well qualified to carry out the proposed work. This project is a clear and logical progression that builds on previous work by group members, including other CALFED funded projects. The addition of a subcontractor to oversee isotope analysis was a good choice.**
Rating	**Superior**

Overall Evaluation Summary Rating

Comments	**This proposal draws together many types of data from several well-chosen study areas into a clear and compelling rationale. The theme of terrestrial-aquatic energetic reliances provides a strong conceptual base for the study, and is bound to provide important new insights regarding the ecological linkages between land and water in the North Delta region. The proposal speaks directly to PSP topics 3 and 4 (population and ecosystem response to climate change, habitat availability and response to change). The large and highly experienced team is appropriate for the project's substantial scope, and the budget is detailed and seems very reasonable and well justified. The many existing ties among project staff and management and conservation groups will enhance the success of the project's outreach component.**
Rating	**Superior**

External Technical Review #3

Proposal Title: Future of the Delta: Measuring Biodiversity and Energetic Reliance in Key North Delta Habitats

Proposal Number: 0039

Proposal Applicant: The Regents of the University of California

Purpose

Comments	**Goals etc are clearly stated and quickly made relevant to Delta area issues. The project is very timely in its objectives with regard to habitat loss, climate change, and potential levee degradation. It is also timely in its clearly stated objective of characterizing regions that may serve as potential refuges for local species in the event of further habitat loss and climate change, and how habitat restoration might best proceed.**
Rating	**Superior**

Background

Comments	**The background ideas and questions are clear, without an explicit model. The conceptual model presented in Appendix 3 is more of a description of how components will be analyzed/tested than an actual model. The foodweb linkage diagram on p. 4 of the background section is convincing in showing interdependence of terrestrial and aquatic systems, but I think the organisms are Japanese and a reference isn't provided.**
Rating	**Above Average**

Approach

Comments	**The approach appears more than adequate and is clearly laid out, including the distribution of**

	responsibilities. Resources appear sufficient. To accomplish the goals of defining potential refuges, the underlying faunal, floral, and landscape characterizations are crucial (I suspect the energetics/food web component is equally useful but I am unqualified in that area). If investigators succeed in identifying how areas will serve as future refuges given the biologies of the organisms involved, their findings should lay the groundwork for management and policy decisions in the future. The investigators have gone to lengths to show how their findings will contribute to several other ongoing studies and how data sharing will occur. Plans for dissemination are adequate (this question always strikes me as largely irrelevant; investigators can promise anything as far as dissemination is concerned. However, their comment about circulating reports to landowners who have allowed access to land (p. 15, deliverables) should be reconsidered. It might also prove productive to disseminate results to private landowners who didn't allow access to show sincerity of the project and to develop better relations in the future. This might dispel some of the mistrust that exists in (some) minds. Hiding the reports would be counterproductive.
Rating	**Superior**

Feasibility

Comments	**Investigators have done a good job convincing me that this is an ambitious yet doable investigation and have provided an adequate plan and timetable. Most of the field methods are well-established (again, I am unqualified to critique the energetics portion).**
Rating	**Superior**

Budget

Comments	**Budget details seem appropriate and thought out. I really can’t judge whether it is reasonable or adequate.**

Rating	**Superior**

Relevance To CALFED

Comments	**Among the CALFED proposals I've reviewed in the past, this one is clearest in its relevance to Delta region problems and CALFED priorities. Assessment of habitat availability for important and indicator species and communities and assessing habitat availability is clearly of value, as is increased understanding of the ecological functions and interactions among species.**
Rating	**Superior**

Qualifications

Comments	**The line-up of personnel is impressive. They are clearly qualified both in terms of their backgrounds, skills, accomplishments, and ongoing involvement in the region. I am especially impressed with the appended letters of support from government and non-government organizations, showing that this study will be noticed and utilized by external groups in their future work (if the Davis City Manager actually wrote that letter, he would pass any PhD ecology oral examination I've participated in).**
Rating	**Superior**

Overall Evaluation Summary Rating

Comments	**This is a truly superior proposal in all regards; results will reflect positively on CALFED. It may not be as sexy or high tech as many proposals, but the information that will potentially come out of it and the application of that knowledge could be extremely useful.**
Rating	**Superior**